Equipment and expertise at the Process Development Unit helps industry partners pilot customized biomass preprocessing designs. The PDU's flexible configuration accommodates both third-party equipment and a wide range of process designs so biorefineries can troubleshoot feed handling problems before costly capital outlays.

Changing the World's Energy Future

Process Development Unit

A modular, fully integrated, full-size biomass preprocessing system

Poor feed handling is one of the primary reasons commercial plants that process bulk solids often operate at a fraction of design capacity during their first year.

A single feed handling problem—anything from a plugged auger to a broken conveyer—may bring the plant to a standstill until the problem is resolved.

Researchers at the Department of Energy's Biomass Feedstock National User Facility (BFNUF) specialize in scale up and integration of biomass preprocessing facilities.

BFNUF's primary capability is the Process Development Unit (PDU), a full-size, fully integrated feedstock preprocessing system. The PDU allows industry partners to test a variety of grinding, drying, pelletizing, cubing, torrefaction, and mechanical and chemical separation options.

The PDU's flexible configuration allows for insertion of third-party equipment and a wide range of process designs so biorefineries can minimize or eliminate feed-handling problems before costly capital outlays.

With the Process Development Unit and its counterparts—the Characterization Laboratory and the Bioenergy Feedstock Library—the BFNUF offers the bioenergy industry a world-class feedstock preprocessing research and development resource.

PDU Overview

The PDU is capable of processing a variety of feedstocks at up to 5 tons per hour. Since its construction in 2009, it has processed more than 1,150 tons of feedstocks.

Examples of PDU capabilities:

- Toll processing for R&D
- Feedstock supply sourcing and custom blends
- Industrial feedstocks developed at commercial specifications
- Validation and testing of third-party technology
- Multiple sources of the same feedstock type for variability comparisons
- Full-scale control and equipment test bed

INL
Idaho National Laboratory

Examples of feedstocks tested at the PDU:

- Agricultural residues: corn stover, wheat straw, sugar cane bagasse
- Grasses: switchgrass, miscanthus, energy sorghum, reed canary grass
- Woody biomass: tree chips, logging residues
- Municipal solid waste
- Cellulosic coproduct

Modular Design

The PDU is comprised of four modules: decomposition, grinding, drying and densification. Each module breaks down into smaller units that fit into standard shipping containers for transport to collaborator sites. The modular system provides easy reconfiguration allowing users to conduct process development, design and scale up of preprocessing and feed-handling systems at INL's 27,000-square-foot high bay in Idaho Falls or at partner locations.

Decomposition/Stage I grinding

- Bale scale
- Dual rotor horizontal grinder with bale capacity up to 4-by-4-foot cross sections
- Size reduction for bales and bulk material through screens ranging from 6 inches to 3/16 inch

Drying

- Three-pass rotating drum allows operation as single pass flash dryer or cycled for optimum moisture content
- Variable heat furnace
- Variable blower
- Cyclone separator
- Pneumatic conveyance
- Feed stream can be diverted if drying is not required

Stage II grinding (Hammer Mill)

- Size reduction through screens ranging from 2 inches to 5/64 inch
- Plenum chamber: pneumatic-assisted grinding, dust collection and control
- Metering bin: decouples upstream and downstream feed-handling rates

Densification

- Densifies ground material to more than 40 pounds per cubic foot
- Pellets, cubes or briquettes
- Cooler to improve quality and durability

Packaging options

- Super sacks
- Compression bags
- Bulk loading

The PDU's control room has two computer workstations, which allow operation of integrated equipment via a Distributed System Manager. A data logger records measurements from various instrument sensors and motor current draws. These measurements allow the operator to track and record important variables such as moisture and grinding energy to help partners understand trade-offs during commercial-scale preprocessing.

Since its construction in 2009, the PDU has processed more than 1,150 tons of feedstocks.

For more information

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